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Battelle Pacific Northwest Labs., Richland, WA

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THE MINNESOTA 1973 ATMOSPHERIC BOUNDARY LAYER EXPERIMENT
Micrometeorological and Tracer Data Archive
Set 1 (Revision 2) Documentation Report

by

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16. ABSTRACT

An archive for micrometeorological and tracer dispersion data has been developed by Battelle, Pacific Northwest Laboratories for the U.S. Environmental Protection Agency. The archive is designed to make the results of extensive field tests readily accessible to EPA for model testing, development, and verification efforts.

This report provides documentation for one of the archived data sets, The Minnesota 1973 Boundary Layer Experiment. The aim of this effort is to archive invaluable data sets in a timely fashion before the necessary supporting information about the data becomes lost forever.

The entries in this documentation report are as follows: data set fact summary, a narrative description of experiment and data, special information, references, a description of archive data files, contacts (names, addresses, and phone numbers) and standard experiment summary table. Revision 2 includes previously unpublished rawinsonde profile data.

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This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ABSTRACT

An archive for micrometeorological and tracer dispersion data has been developed by Battelle, Pacific Northwest Laboratories for the U.S. Environmental Protection Agency. The archive is designed to make the results of extensive field tests readily accessible to EPA for future model testing, development, and verification efforts. The aim is to archive these invaluable data sets in a timely fashion before the necessary supporting information about the data becomes lost forever.

This report provides documentation for a revision of the archived data sets, the Minnesota 1973 Boundary Layer Experiment. These data are contained in micrometeorological and tracer archive set 1, revision 2. The data consist of boundary layer profiles of wind and temperature variables, related statistical parameters, and previously unpublished rawinsonde profiles. Additional rawinsonde profiles were added to the archive in revision 2 as well as correcting the units for a wind speed entry in previously archived data.

The entries in this documentation report are as follows: data set fact summary, a narrative description of experiment and data, special information, references, a description of archive data files, contacts (names, addresses, and phone numbers) and standard experiment summary table.

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The authors wish to acknowledge the foresight of the U.S. Environmental Protection Agency's Atmospheric Sciences Research Laboratory in initiating a project with the intent of preserving valuable data bases in a form readily available to the technical community. John S. Irwin's contribution in conceiving and guiding the effort as Project Officer is gratefully acknowledged. This effort was dependent upon information graciously provided by others. We especially thank Yutaka Izumi of the Air Force Geophysical Laboratory who provided the original Minnesota 1973 rawinsonde data so that it could be added to the data set.

SECTION 1

INTRODUCTION

The Meteorology and Assessment Division of the U.S. Environmental Protection Agency's (EPA's) Atmospheric Sciences Research Laboratory has initiated a project to develop and establish an archive of original experimental data and documentation for use by atmospheric-dispersion and boundary layer researchers. The archive of data sets will be useful for evaluating and improving modern dispersion models, ensuring the retention of these data for the future, and making them more readily available to the research community.

This report documents the micrometeorological and tracer (M&T) data archive for the Minnesota 1973 Atmospheric Boundary Layer Experiment and provides listings of the data set documentation entries. This information is also provided in ASCII files on the data archive tape.

The archive includes both documentation and data. A data set documentation report is prepared for each archived data set. The archive is contained in five or more files on magnetic tape. These files consist of a header file, three documentation files, and one or more data files.

The data are entered into the archive in as close to original form as possible to maintain a clear link with original records. The archived data are contained within a well-defined structure called a data map. The data map allows data to be entered in original formats, while providing the user with a machine-readable pathway for accessing the diverse data formats.

Detailed information that the user will find useful, if not essential, is contained in "Introduction to Micrometeorological and Tracer Data Archive Procedures" (Droppo and Watson, 1985). That report provides an overview of the archive and specific guidance for using it in addition to providing a summary of the data sets in the archive. Additional information on the development of the M&T archive may be found in Droppo (1986).

Questions about the archive not answered by this report or the data introduction report (Droppo and Watson, 1985) should be directed to:

U.S. Environmental Protection Agency
Atmospheric Sciences Research Laboratory
Meteorology Assessment Division
Research Triangle Park, North Carolina 27711

SECTION 2

DATA SET DOCUMENTATION ENTRIES

The data set documentation entries for the Minnesota 1973 Atmospheric Boundary Layer Experiment are given below.

DATA SET FACT SUMMARY

Archive Set Title: M&T DATA ARCHIVE SET 001 (REVISION 2)

Experiment Type: Micrometeorological, planetary boundary layer, surface boundary layer.

Name: Minnesota 1973.

Purpose: To make measurements of 1) the vertical fluxes of momentum and heat and 2) profiles of wind velocity and temperature within the planetary boundary layer.

Location: Northwestern Minnesota.

Time: Late summer, 1973.

Number of Tests: 11

Nature of Experiment: A full-scale measurement program over flat, smooth terrain to measure turbulent fluxes at multiple levels from a 32-m tower and a tethered balloon.

Meteorological Conditions: Fully developed stationary convective periods. Mixing depths to approximately 2300 m.

Meteorological Measurements:
- Mean profiles of winds and temperatures.
- Fluctuations of three wind components and temperatures.

Measurement Methods:
- Tower
- Tethered balloon
- Rawinsondes

NARRATIVE DESCRIPTION OF EXPERIMENT AND DATA

Site

A full-scale planetary boundary layer field experiment was conducted in northwestern Minnesota in the late summer of 1973 (Izumi and Caughey, 1976;Readings, Haugen and Kaimal, 1974). The site was at the middle of the southern edge of an extremely flat, square-mile section of farm land about 3 km east of Donaldson (48 degrees 34'N latitude and 96 degrees 51'W longitude; elevation 255 m above sea level). The surface cover was wheat stubble and narrowed soil. The fetch was undisturbed for 10 km to the north in the wind direction used for observations.

Measurements

The data from the surface to 32 m were collected from a tower, and those from 61 to 1220 m were collected from a 330-cu-m kite balloon. A second 4-m tower was located 40 m away from the main tower and supported one level of turbulence instrumentation. The specific measurements, elevations, methods, and observation schedules are listed below:

MEASUREMENTS	LOCATION	METHOD	FREQUENCY
Mean wind speed and wind direction	at 1, 2, 4, 8, 16, and 32 m	Two-axis sonic anemometers	Continuous for 11 afternoon periods
	5 levels from 61 to 1220 m	MRU turbulence probe (magneflux vane and cup)	
Mean temperatures	at 0.5, 1, 2, 4, 8, 16, and 32 m	Quartz thermometers	"
	5 levels from 61 to 1220 m	Platinum wire resistance thermometers	
Fluctuating wind components (U,V,W) and temperature	at 4 and 32 m on main tower and 4 m on adjacent mask	Three-axis sonic anemometers	"
	at 5 levels from 61 to 1220 m	Hot wire inclinometers Eight cup polystyrene rotor Platinum wire thermometer	
Pressure, temperature, relative humidity, and wind speed	to 3 km	Slow-ascent rawinsonde	Every 2 h day and evening, and 3 to 4 h at night

The tower winds and temperatures were sampled once per second, and the tower and balloon turbulence instruments were sampled 10 times per second.

Drag plate measurements were reportedly attempted but their success is not known and not reported.

Data

Eleven 75-minute runs were documented by Izumi and Caughey (1976) and are contained in this archive. The reported results did not contain the slow ascent rawinsonde data, however, and these have been added in this archive using original data provided by Izumi. These runs span the period from early to late afternoon, although data were collected through the nocturnal transition. The nocturnal transition data were not analyzed or reported by Izumi and Caughey and are not part of the data archive at this time; however, they are the subject of a journal article by Caughey, Wyngaard and Kaimal (1979).

The archived data consist of the data tables reported by Izumi and Caughey (1976) and the added rawinsonde data. The data tables for each run include:

1) summary statistics including: U*, Qo, T*, L, Zi, Zi/L, w*, O*, u*/fzi.

2) profiles of temperature, wind speed and direction, velocity component and temperature standard deviations, and momentum and heat fluxes.

The unpublished rawinsonde values were checked as part of the archiving process. The raw rawinsonde data were used to recompute the wind profiles. This was accomplished using a rawinsonde computer program at the Hanford Meteorological Station. Reasonable agreement occurred between the outputs of this program and the reduced data listings for most of the profiles. The following lists the exceptions that were found. Ascension numbers 36, 40, and 58 had wind speeds that seemed too high, and ascension numbers 17, 18, 26, 54, and 57 had wind speeds that seemed too low. Also ascension number 17 wind directions did not agree. All the profiles of temperature and relative humidity were checked and appeared to be correctly derived. Some of the discrepancies noted may be the result of using different recording intervals. The failure to duplicate certain profiles does not mean they are incorrect, but that these identified profiles should be used with caution. The archived data includes both the raw and reduced data listings. The pressure, temperature and humidity rawinsonde profiles were added to the archive in revision 2.

SPECIAL INFORMATION

Some unique aspects of the Minnesota 1973 data are the high vertical spatial density of comparable turbulence measurements in the surface layer and extending to a height of 1220 m in the mixed layer. Profile and turbulence measurements above 32 m were obtained utilizing the balloon-borne instruments and techniques developed by the Meteorological Research Unit (MRU) of the British Meteorological Office, Royal Air Force, Cardington, England (Readings and Butler, 1972). The comparability of the tower and balloon-borne instruments and measurements was established before the Minnesota 1973 experiment by Readings and Butler (1972) and Haugen et al. (1975). In addition, comparability

tests were made before each field run during the experiment. These comparisons and the Minnesota experiment have an added significance in that they establish a basis for comparability to a significant body of data generated by the MRU over many years in the United Kingdom.

A question arose about the correct units for wind speeds for the rawinsonde data. The original data sheets have a printed label of "m.p.s." which was used in the data map for revision 1. An user of the archive reported that these values appeared to be inconsistent with other concurrent data. A check of the original data sheets revealed that the "m.p.s." label was crossed out on about half the sheets and the letters "kts" (assumed to mean knots) inserted. Knots are also used to report the measured surface wind speed at the time of release. The data map in revision 2 has been revised to show units of knots for the wind speed profiles derived from tracking the rawinsondes.

DOCUMENTATION

This section provides a list of related documents for the Minnesota 1973 data. References cited in this report may not be included in the following documentation list, but they will be included in the reference list at the end of the report.

The original Minnesota 1973 data for the 11 reported runs and a detailed description of the experiment are contained in the report by Izumi and Caughey (1976) and the paper by Readings, Haugen and Kaimal (1974). The data for the nocturnal transition period were transferred to and analyzed and reported by Caughey, Wyngaard and Kaimal (1979).

A list of the reports and papers mentioned above for the Minnesota 1973 data follows:

Caughey, S. J., J. C. Wyngaard, and J. C. Kaimal. Turbulence in the Evolving Stable Boundary Layer. J. Atm. Sci., 36:1041-1052, 1979.

Haugen, D. A., J. C. Kaimal, C. J. Readings, and R. Rayment. A Comparison of Balloon-Borne and Tower-Mounted Instrumentation for Probing the Atmospheric Boundary Layer. J. Appl. Meteor., 14:540-545, 1975.

Izumi, Y., and J. S. Caughey. Minnesota 1973 Atmospheric Boundary Layer Experiment Data Report. AFCRL-TR-76-0038, Environmental Research Papers No. 547, Meteorology Laboratory, Project 7655, Air Force Cambridge Research Laboratories, Hanscom AFB, Massachusetts, 1976.

Readings, C. J., and H. E. Butler. The Measurement of Atmospheric Turbulence from a Captive Balloon. Meteor. Mag., 101:286-298, 1972

Readings, C. J., D. A. Haugen, and J. C. Kaimal. The 1973 Minnesota Atmospheric Boundary Layer Experiment. Weather, 29:309-312, 1974.

Additional references for these data are:

Caughey, S. J., and S. G. Palmer. Some Aspects of Turbulence Structure Through the Depth of the Convective Boundary Layer. Quart. J. R. Meteorol. Soc., 105:811-827, 1979.

Kaimal, J. C., J. C. Wyngaard, D. A. Haugen, O. R. Cote, Y. Izumi, S. J. Caughey, and C. J. Readings. Turbulence Structure in the Convective Boundary Layer. J. Atm. Sci., 33:2152-2169, 1976.

Kaimal, J. C. Horizontal Velocity Spectra in an Unstable Surface Layer.J. Atm. Sci., 35:18-24, 1978.

Wyngaard, J. C. Modeling the Planetary Boundary Layer - Extension to the Stable Case. Boundary Layer Meteorol., 9:441-460, 1975.

FILE DESCRIPTION

Overview

The archived Minnesota 1973 data are in one file consisting of five tables of published results and two additional tables of unpublished temperature, humidity, and wind soundings. A data map variables listing, data subset summary, subset data variables listings, and the data file characteristics are summarized in tabular form below.

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1

NAME	\UNITS	\RECORD	\DEFINITION
ALTITUDE	\ORDINATE	\1559	\Altitude - Mandatory levels
ASCENTNUM	\NO UNITS	\0519	\Ascent number
ASCENTNUM	\NOUNITS	\1553	\Ascent Number
ASCENTNUM	\NOUNITS	\1566	\Ascent Number
ASCENTNUM	\NOUNITS	\1575	\Ascent Number
ASCENTNUM	\NOUNITS	\1577	\Ascent Number
AZMANG	\DEG	\0524	\Azimuth Angle
CLOUDSOBS	\TEXT	\1576	\Surface cloud and weather observations
DATE	\YRMODA	\0034	\Year,Month,Day
DATE	\YRMODA	\0072	\Year,Month,Day
DATE	\YRMODA	\0225	\Year,Month,Day
DATE	\YRMODA	\0324	\Year,Month,Day
DATE	\YRMODA	\0517	\Year,Month,Day
DATE	\YRMODA	\1554	\Year,Month,Day
DEWPOINT	\DEG C	\1564	\Dew point ascent - computed for some cases
DEWPOINTD	\DEG C	\1565	\Dew point depression - computed for some cases
ELVANG	\DEG	\0523	\Elevation angle
HGT	\M	\0075	\Height of measurement
HGT	\M	\0228	\Height of measurement
HGT	\M	\0327	\Height of measurement
HGTRAW	\M	\0522	\Rawin height above sfc
HGTZI	\M	\0042	\Zi PBL height from raws
HGTZMAX	\M	\0037	\Ht of highest MRU probe
MOL	\CM	\0041	\L Monin-Obukhov Length
NOTESARCH	\TEXT	\0527	\Archiving notes
NOTESARCH	\TEXT	\1578	\Notes on archived data
PRESSURE	\MB	\1558	\Pressure
PRESSURER	\CONTACT	\1557	\Contact pressure value
QSUBO	\C CM/S	\0039	\Qo surface heat flux
RATIO1	\NONDIMEN	\0046	\U*/(f Zi)
RELHUM	\PERCENT	\1563	\Relative humidity during ascent
RELHUMBLO	\NOUNITS	\1571	\Relative humidity Ordinate - baseline check
RELHUMBLP	\PERCENT	\1572	\Relative humidity Psychrometer - baseline check
RELHUMR	\ORDINATE	\1562	\Relative humidity ordinate
RUN	\NO UNITS	\0033	\Run number
RUN	\NO UNITS	\0071	\Run Number
RUN	\NO UNITS	\0224	\Run Number
RUN	\NO UNITS	\0323	\Run Number
RUN	\NO UNITS	\0520	\Run number
TABLE	\NO UNITS	\0032	\Document table number
TABLE	\NO UNITS	\0070	\Document table number
TABLE	\NO UNITS	\0223	\Document table number
TABLE	\NO UNITS	\0322	\Document table number
TEMP	\C	\0076	\Air Temperature
TEMPERATR	\CONTACT	\1560	\Air temperature contact value
TEMPERATU	\DEG C	\1561	\Air temperature during ascent
TEMPERBLD	\DEG C	\1569	\Temperature/Dry - baseline check

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 (CONTINUED)

NAME	\UNITS	\RECORD	\DEFINITION
TEMPERBLO	\NOUNITS	\1568	\Temperature Ordinate - baseline check
TEMPERBLW	\DEG C	\1570	\Temperature/Wet - baseline check
TIMEBASEL	\CDT	\1567	\Time for baseline check readings
TIMELAPSE	\NOTGIVEN	\1556	\Elapsed time-appears to be half minutes
TIMESTART	\CDT	\0035	\Start time for experiment
TIMESTART	\CDT	\0073	\Start time for experiment
TIMESTART	\CDT	\0226	\Start time for experiment
TIMESTART	\CDT	\0325	\Start time for experiment
TIMESTART	\CDT	\0518	\Start time for experiment
TIMESTART	\CDT	\1555	\Start time for experiment
TIMESTEP	\HALFMIN	\0521	\Recording time step
TIMESTOP	\CDT	\0036	\Stop time for experiment
TIMESTOP	\CDT	\0074	\Stop time for experiment
TIMESTOP	\CDT	\0227	\Stop time for experiment
TIMESTOP	\CDT	\0326	\Stop time for experiment
TSCALE	\C	\0045	\(THETA)o
TSTAR	\C	\0040	\T*, scaling temperature
TSTD	\C	\0232	\T standard deviation
UDIR	\DEGREE	\0078	\Wind Direction at true N
UDIRECSFC	\DEGREES	\1573	\Surface wind direction at release time
USPD	\CM/S	\0077	\Wind Speed
USPDRAW	\KNOTS	\0526	\Wind speed (units-see note)
USPEEDSFC	\KNOTS	\1574	\Surface wind speed at release time
USTAR	\M/S	\0038	\Friction velocity
USTD	\CM/S	\0229	\U standard deviation
UWBAR	\CM2/S2	\0328	\UW momentum flux
VSTD	\CM/S	\0230	\V standard deviation
VWBAR	\CM2/S2	\0329	\VW momentum flux
WDIRRAW	\DEG	\0525	\Wind direction(360=N)
WSTAR	\CM/S	\0044	\W*
WSTD	\CM/S	\0231	\W standard deviation
ZIOMOL	\NONDIMEN	\0043	\Zi/L stability parameter

SUBSET SUMMARY FOR M&T DATA ARCHIVE SET 1

SUBSET NUMBER	TITLE
0001	Run Summary
0002	Profiles of Temperature, Wind Speed, and Wind Direction
0003	Velocity Component and Temperature Standard Deviation Profiles
0004	Momentum Flux Profiles
0005	Heat Flux Profiles
0006	Rawinsonde Profiles -- Wind Speed and Direction
0007	Rawinsonde Profiles -- Pressure, temperature, and humidity

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 - SUBSET 1

NAME	\UNITS	\RECORD	\DEFINITION
DATE	\YRMODA	\0034	\Year,Month,Day
HGTZI	\M	\0042	\Zi PBL height from raws
HGTZMAX	\M	\0037	\Ht of highest MRU probe
MOL	\CM	\0041	\L Monin-Obukhov Length
QSUB0	\C CM/S	\0039	\Qo surface heat flux
RATIO1	\NONDIMEN	\0046	\U*/(f Zi)
RUN	\NO UNITS	\0033	\Run number
TABLE	\NO UNITS	\0032	\Document table number
TIMESTART	\CDT	\0035	\Start time for experiment
TIMESTOP	\CDT	\0036	\Stop time for experiment
TSCALE	\C	\0045	\(THETA)o
TSTAR	\C	\0040	\T*, scaling temperature
USTAR	\M/S	\0038	\Friction velocity
WSTAR	\CM/S	\0044	\W*
ZIOMOL	\NONDIMEN	\0043	\Zi/L stability parameter

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 - SUBSET 2

NAME	\UNITS	\RECORD	\DEFINITION
DATE	\YRMODA	\0072	\Year,Month,Day
HGT	\M	\0075	\Height of measurement
RUN	\NO UNITS	\0071	\Run Number
TABLE	\NO UNITS	\0070	\Document table number
TEMP	\C	\0076	\Air Temperature
TIMESTART	\CDT	\0073	\Start time for experiment
TIMESTOP	\CDT	\0074	\Stop time for experiment
UDIR	\DEGREE	\0078	\Wind Direction at true N
USPD	\CM/S	\0077	\Wind Speed

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 - SUBSET 3

NAME	\UNITS	\RECORD	\DEFINITION
DATE	\YRMODA	\0225	\Year,Month,Day
HGT	\M	\0228	\Height of measurement
RUN	\NO UNITS	\0224	\Run Number
TABLE	\NO UNITS	\0223	\Document table number
TIMESTART	\CDT	\0226	\Start time for experiment
TIMESTOP	\CDT	\0227	\Stop time for experiment
TSTD	\C	\0232	\T standard deviation
USTD	\CM/S	\0229	\U standard deviation
VSTD	\CM/S	\0230	\V standard deviation
WSTD	\CM/S	\0231	\W standard deviation

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 - SUBSET 4

NAME	\UNITS	\RECORD	\DEFINITION
DATE	\YRMODA	\0324	\Year,Month,Day
HGT	\M	\0327	\Height of measurement
RUN	\NO UNITS	\0323	\Run Number
TABLE	\NO UNITS	\0322	\Document table number
TIMESTART	\CDT	\0325	\Start time for experiment
TIMESTOP	\CDT	\0326	\Stop time for experiment
UWBAR	\CM2/S2	\0328	\UW momentum flux
VWBAR	\CM2/S2	\0329	\VW momentum flux

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 - SUBSET 5

NAME	\UNITS	\RECORD	\DEFINITION
ASCENTNUM	\NO UNITS	\0519	\Ascent number
AZMANG	\DEG	\0524	\Azimuth Angle
DATE	\YRMODA	\0517	\Year,Month,Day
ELVANG	\DEG	\0523	\Elevation angle
HGTRAW	\M	\0522	\Rawin height above sfc
NOTESARCH	\TEXT	\0527	\Archiving notes
RUN	\NO UNITS	\0520	\Run number
TIMESTART	\CDT	\0518	\Start time for experiment
TIMESTEP	\HALFMIN	\0521	\Recording time step
USPDRAW	\KNOTS	\0526	\Wind speed (units-see note)
WDIRRAW	\DEG	\0525	\Wind direction(360=N)

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 - SUBSET 6

NAME	\UNITS	\RECORD	\DEFINITION
ASCENTNUM	\NO UNITS	\0519	\Ascent number
AZMANG	\DEG	\0524	\Azimuth Angle
DATE	\YRMODA	\0517	\Year,Month,Day
ELVANG	\DEG	\0523	\Elevation angle
HGTRAW	\M	\0522	\Rawin height above sfc
NOTESARCH	\TEXT	\0527	\Archiving notes
RUN	\NO UNITS	\0520	\Run number
TIMESTART	\CDT	\0518	\Start time for experiment
TIMESTEP	\HALFMIN	\0521	\Recording time step
USPDRAW	\KNOTS	\0526	\Wind speed (units-see note)
WDIRRAW	\DEG	\0525	\Wind direction(360=N)

DATA VARIABLES LISTING FOR M&T DATA ARCHIVE SET 1 - SUBSET 7

NAME	\UNITS	\RECORD	\DEFINITION
ALTITUDE	\ORDINATE	\1559	\Altitude - Mandatory levels
ASCENTNUM	\NOUNITS	\1553	\Ascent Number
ASCENTNUM	\NOUNITS	\1566	\Ascent Number
ASCENTNUM	\NOUNITS	\1575	\Ascent Number
ASCENTNUM	\NOUNITS	\1577	\Ascent Number
CLOUDSOBS	\TEXT	\1576	\Surface cloud and weather observations
DATE	\YRMODA	\1554	\Year,Month,Day
DEWPOINT	\DEG C	\1564	\Dew point ascent - computed for some cases
DEWPOINTD	\DEG C	\1565	\Dew point depression - computed for some cases
NOTESARCH	\TEXT	\1578	\Notes on archived data
PRESSURE	\MB	\1558	\Pressure
PRESSURER	\CONTACT	\1557	\Contact pressure value
RELHUM	\PERCENT	\1563	\Relative humidity during ascent
RELHUMBLO	\NOUNITS	\1571	\Relative humidity Ordinate - baseline check
RELHUMBLP	\PERCENT	\1572	\Relative humidity Psychrometer - baseline check
RELHUMR	\ORDINATE	\1562	\Relative humidity ordinate
TEMPERATR	\CONTACT	\1560	\Air temperature contact value
TEMPERATU	\DEG C	\1561	\Air temperature during ascent
TEMPERBLD	\DEG C	\1569	\Temperature/Dry - baseline check
TEMPERBLO	\NOUNITS	\1568	\Temperature Ordinate - baseline check
TEMPERBLW	\DEG C	\1570	\Temperature/Wet - baseline check
TIMEBASEL	\CDT	\1567	\Time for baseline check readings
TIMELAPSE	\NOTGIVEN	\1556	\Elapsed time-appears to be half minutes
TIMESTART	\CDT	\1555	\Start time for experiment
UDIRECSFC	\DEGREES	\1573	\Surface wind direction at release time
USPEEDSFC	\KNOTS	\1574	\Surface wind speed at release time

HEADER FILE OF DATA TAPE, MICROMETEOROLOGICAL AND TRACER DATA ARCHIVE SET NUMBER 1, REVISION 2, MINNESOTA 1973 ATMOSPHERIC BOUNDARY LAYER EXPERIMENT

TAPE FILE	FILE CONTENTS	BLOCK SIZE BYTES	LOGICAL RECORD LENGTH	LINES PER BLOCK	FILE TOTAL LINES	FILE TOTAL CHAR*	ODD CHECK-SUM*	EVEN CHECK-SUM*
FILE#1	HEADER FILE,	2600	130	20	13	(Based on printable		
FILE#2	DOCUMENTATION REP.	2600	130	20	1255	ASCII bytes exclud-		
FILE#3	VARIABLES LIST	2600	130	20	60	ing trailing blanks		
FILE#4	EXPER.SUMMARY(SES)	2600	130	20	28	in each line.)		
FILE#5	MINNESOTA 1973 DATA	2000	130	20	2238	49049	68556	80493

REVISION LOG FOR M&T DATA ARCHIVE 001

ARCHIVE NUMBER	REVISION NUMBER	DATE	NOTES
001	000	12-26-84	Draft Data Archive
001	001	6- 5-85	Revised Data Archive
001	002	11-26-86	Revised and Expanded Data Archive

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STANDARD EXPERIMENT SUMMARY

Following is a listing of the values of variables of common interest that may be used to determine the relative utility of the subject data set or individual runs within the data set. This list does not represent all the variables in the Minnesota 1973 data set. The full nature of the data set is outlined above and is defined precisely in the data map.

The definitions of each of the variables are found below.

NUM	RUN	MON	DAY	YR	TIM	PER	U*	T*	-L	Zo	Uo	W*	O*	Zi
1	2A1	9	10	73	12	1:15	45	-.43	42	-99	9.9	200	.10	1250
1	2A2	9	10	73	13	1:15	45	-.46	38	-99	10.1	223	.09	1615
1	3A1	9	11	73	15	1:15	37	-.50	24	-99	7.9	241	.08	2310
1	3A2	9	11	73	16	1:25	32	-.36	24	-99	7.2	206	.06	2300
1	5A1	9	15	73	16	1:15	18	-.39	7	-99	4.0	135	.05	1085
1	6A1	9	17	73	14	1:15	24	-.88	6	-99	6.1	243	.09	2095
1	6A2	9	17	73	15	1:25	23	-.71	6	-99	6.0	221	.07	2035
1	6B1	9	17	73	16	1:15	26	-.27	23	-99	6.1	177	.04	2360
1	7C1	9	19	73	14	1:15	28	-.79	9	-99	5.8	195	.11	1020
1	7C2	9	19	73	15	1:15	30	-.60	13	-99	5.6	189	.10	1140
1	7D1	9	19	73	16	1:15	25	-.40	14	-99	5.0	158	.06	1225

NUM = Micrometeorological archive number.
RUN = Experiment run number as defined in the original data set.
MON, DAY, YR = Month, day and year of the run.
TIM = Hour of the day during which the experiment started.
PER = The duration, or period, of the experiment in hours and minutes.
U* = Friction velocity = (- uw)0.5, cm/sec.
T* = Scaling temperature = -Q/U*, degrees C, where Q = surface heat flux (C cm/sec).
L = Obukhov length = -(U*3T)/(kgQ), m.
Zo = Roughness length, cm.
Uo = Surface wind velocity (the measurement closest to 10 m above the surface), m/s.
W* = Vertical velocity scale = ((g/T)QZi)1/3, cm/sec.
O* = Temperature scale = Q/W*, degrees C.
Zi = Height of boundary layer, m.
-99 = Indicates variable not reported or missing.

REFERENCES

Droppo, J. G., and C. R. Watson. Introduction to Micrometeorological and Tracer Data Archive Procedures, EPA-600/3-85/053, Environmental Protection Agency, Research Triangle Park, North Carolina, June 1985.

Droppo, J. G. Development of A Micrometeorological and Tracer Data Archive, EPA-600/ / , Environmental Protection Agency, Research Triangle Park, North Carolina, August 1986.